THE LEADING EDGE

Newsletter of the Northern Illinois Rocketry Association, NAR Section #117

Volume 23, Number 4 July/August 2000

Club News

Launch Updates – Watch the Grass Grow 2000 has been scheduled (see the announcement on the right side of this page).

There is a Youth Group launch scheduled for August 27th (the week after the regular club launch). As of this point, there aren't any groups scheduled. If there aren't any groups signed up by the regular club launch, we'll probably use August 27th as an additional club launch. Check the NIRA infoline (630-483-2468) or look at the website at http://nira.chicago.il.us to confirm the status of this launch!

Meeting Dates – There have been a couple of questions about the NIRA meeting schedule after August. The civic center schedules their rooms from September through August and the list of available dates is expected soon.

In prior years, because of civic center scheduling, we have had to change either the locations or the dates of the September and October meetings. This will be announced as soon as the schedule is published.

Family Band Radios – At the July meeting, the club voted to buy 4 family band radios for club use. These radios will assist the club in running a high quality range at our larger launches as well as assisting with contests the club runs.

Club Trailer – The club discussed buying a trailer to haul the club-owned gear in. Although everyone in attendance thought the idea was good, it was tabled until a storage location for the trailer could be located.

Anyone with a low/no cost location for storing the trailer should let one of the officers know.

Logo Contest – The vote for the club logo has been postponed yet again – to the September meeting (since most club officers won't be attending the August meeting due to NARAM)

If you need to refresh you memory of the entries, they were published in the last Leading Edge which is available online on the NIRA web site (http://nira.chicago.il.us).

Chicago Hobby Show!

Chicago Hobby Show – We have the dates! The show will be October 21st through the 22nd. So mark your calendars. The place is the Rosemont Expo Center. What is this? This is the largest hobby related show ever. There are "Hands On" RC trucks, cars, boats, demos of RC helicopters, slot cars, trains, games, you name it. But don't forget the most important - the "Make it, Take it" booths.

This is where NIRA comes in. We need people to volunteer to staff the booth and help people build a rocket kit. If you sign up to help, your admittance into the show is FREE!! In the past years we have assisted in the building of roughly around 1200 rocket kits at each event.

If you are interested in helping please contact Jane Piette at 630-513-6920 or through email at jane@simon.chi.il.us.

We will have more information for you about the show as we get closer. This information will be accessible through the Leading Edge, or the web site at:

http://www.nira.chicago.il.us/RCHTA-2k.htm

'Watch the Grass Grow 2000' NIRA's High Power Launch

No ponds. No gravel parking lots. No swamps. No tall grass. No entry tolls. Just lots of really nice mowed grass (but please don't park/drive on the grass).

NIRA will be holding a High Power launch at the Beaver Run Sod Farm north of Harvard, IL on September 2-3, 2000 (Saturday and Sunday of Labor Day weekend) from 9 am to 5 pm.

Because of the nature of the launch, we will be charging a fee for anyone who wants to launch. The fees are as follows:

WTGG Fees	Weekend	One Day
Family	$20.00	$10.00
Adult (16 and up)	$10.00	$5.00
Youth (15 and under)	$4.00	$2.00

This will be run like a typical NIRA launch (i.e. misfire alley) with the exception of several LMR and HPR pads that the club will provide. You

*(**Watch the Grass Grow** continued on page 11)*

Joint Statement on ATF Litigation

(from rec.models.rockets, July 15, 2000)

After a careful and complete review of all options, TRA President Bruce Kelly, TRA Vice President Dick Embry and NAR President Mark Bundick, along with Joe Egan and Marty Malsch of our legal team, met on Friday, July 14, 2000 with ATF staff and counsel to discuss potential settlement of our lawsuit filed against the Bureau of Alcohol, Tobacco and Firearms. During the two hour session, a frank and open discussion occurred and for which, we believe, full consideration of our Associations' positions were given due attention by ATF representatives. Further details cannot be disclosed, as the meeting was protected by legal privilege granted under the Administrative Procedures Act.

All legal options remain open at this time for us to pursue relief from improper and unnecessary regulation of the sport rocket hobby, and we pledge to continue the fight to protect your hobby interests. We appreciate the continued financial and moral support by our members for this battle. That support insures the maximum resources possible are devoted to the effort to protect our safe, educational hobby.

As always, when we have additional status details we can report to members, we will share them as soon as possible.

Mark Bundick, NAR President
Bruce Kelly, TRA President

THE LEADING EDGE

Volume 23, Number 4
July/August 2000

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Send membership applications (dues: $6 per youth, $8 per adult, $12 per family, including a six issue subscription to the Leading Edge), non-member subscriptions ($10 per six issues), and change of address notification to:

Ken Hutchinson
82 Talcott Avenue
Crystal Lake, IL 60014-4541

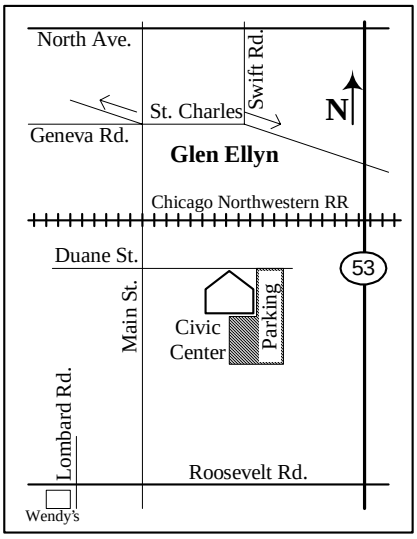
NIRA's web site is at: http://nira.chicago.il.us/

CLUB MEETING DATES

All meetings start at 7:30 pm. Bring a model for 'Model of the Month.' We always need volunteers for pre-meeting lectures, contact Rick Gaff if you want to schedule a date. The location is the Glen Ellyn Civic Center, 535 Duane Street (usually the 3rd floor, but check the board in the lobby).

August 4

September 1 – **note**: in the past, the civic center is usually closed for cleaning about this time. As of the printing of this issue, we still haven't received word about this. **Call the NIRA infoline (630-483-2468) or look at the website at http://nira.chicago.il.us to confirm the date!**



CLUB LAUNCH DATES

Launches are BYOL (bring your own launcher). The location for our launches is the Greene Valley Forest Preserve (see map at right). Call the NIRA infoline for pre-launch information: 630-483-2468.

August 20 – Regular club launch.

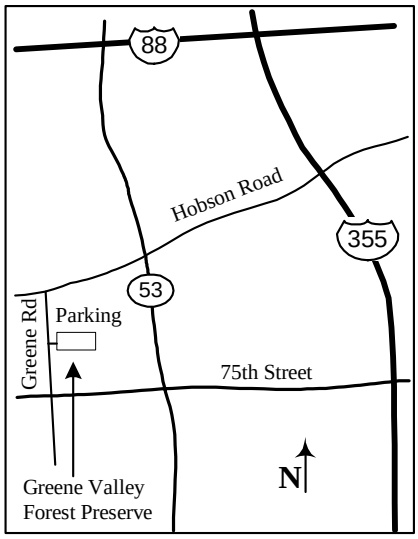
August 27 – Youth Group Launch (at Greene Valley)

September 2-3 – Watch The Grass Grow

September 17 – Greene Valley Forest Preserve

October 15 – Greene Valley Forest Preserve

November 19 – Greene Valley Forest Preserve



Model of the Month Winners! (photos by Rick Gaff)

June – Jeremy Shafton is our youth winner with a scratch built rocket and Bob Wiersbe won in the adult category with his FSI Black Brant.

July – Adrian Butler shows off his Little Joe II kit winning the adult catagory and NIRA's vice President, Pierre Miller his scratchbuilt Ariane 4 wins the youth catagory this month.

My Level 2 Failure
by Bob Wiersbe

You often see posts on rec.models.rockets about someone's Level 1 or Level 2 certification attempt if it has been successful, but rarely do you hear about the failures. Perhaps no one wants to admit they failed, or they are too bummed out about it to want to share it with the world. A lot of effort goes into a certification flight, and your reputation is at stake. So, why would I want to talk about my failure? For one reason – to help others avoid making the same mistakes.

My main motivation for becoming Level 2 Certified was so that I could complete the NAR Trained Safety Officer program. I really don't plan on flying that many J and K motors, but I would like to be able to serve as the RSO at launches.

The first step is to pass the Level 2 written test, which I did with a perfect score along with Steve Piette and Adrian Butler at the NIRA meeting in May. That left me with 4 weeks to build my Level 2 rocket in time for the Midwest Regional Fun Fly (MRFF). I knew that there would be enough Level 2 folks at the launch who could help me out and serve as my certification team, and that the field was big enough for the rocket.

My first problem was not having enough money to buy a rocket that was suitable for a Level 2 attempt. But I had enough parts in my stash to be able to scratch build my own. I had several LOC 3.9" tubes, 38mm motor tube, 3.9" couplers, bulkheads, centering rings, and an ACE nose cone. What was missing was a good shock cord, fin material, and instructions. Scratch building a Level 2 rocket just isn't the same.

For the shock cord I went with 5/8" tubular nylon from Al's Hobbies. I didn't have any good plywood for fins, but I did have some 1/16" G10 material – it was circuit board material without any copper on it. I had saved it from the trash at work years ago not knowing what I'd use it for.

I decided that I would build a baffle into the rocket, using a method that Bob Kaplow had described. I epoxied a 1.25" thick basswood plug into the end of the 38mm motor tube, then drilled 4 rows of holes around the tube just below the plug. The plug stops the ejection gas from exit the top, and the holes allow it to escape out the sides. I epoxied a centering ring below the holes, and epoxied a staging coupler to this ring. I drilled holes through another centering ring, and attached this ring to the stage coupler above the holes in the motor tube. The stage coupler may be overkill, but I felt that it made for a stronger airframe and more reliable baffle design.

Cutting the fins was a major problem. My shop only has a scroll saw and miter saw, and no shear. I tried to use the scroll saw to make cut outs at the base of the fin, and promptly went through 3 blades. That G10 stuff is like diamond sandpaper, it wore the teeth off of the blade in less than an inch! Reluctantly, I decided to use the miter saw. I knew this was going to be messy, and I had heard the warnings of others about cutting this stuff. Well, they were right. Never use a saw on G10. Dust everywhere (thank goodness I at least wore a mask), and it itched!!!

Okay, the fins are done, the tube is slotted, time to put the fins on. Did I mention that it was during this time that I experienced a migraine that went on for 2 weeks? Let's just say that it was a major pain and that I was taking lots of medication. Can you say "Not thinking clearly?" I knew you could.

The fins were designed to be Through-The-Wall (TTW), and I kept the rear centering ring off so that I could add epoxy fillets to all joints. I also added blind nuts to the rear centering ring for the motor retaining clips. Most of the construction was simple, add epoxy, put the parts together, let them dry. Then I ran out of 30 minute epoxy as I was working on the fin fillets. It took me 2 days before I could find a store that was open and had epoxy, but they only had 5, 15, or 2 hour curing times. So, I had to settle for the 15 minute one, which wasn't what I really wanted. But, I told myself, it's only for the external fillets so it won't be so bad.

On June 2nd I finished the construction (one day before MRFF), and managed to paint the beast. It looked good, but felt a little light. It only weighed 3.5 pounds, and I was going to fly this on a J350. After a few hours of work on the computer using Rocksim I knew that the rocket was stable, it needed about a pound of nose weight, and a J350-14W would take it over 4600 feet. No problem. I had already figured that I would need to add nose weight, and had built the payload section to make it easy to add.

Now it was off to MRFF to certify! On the field I was showing people my rocket and getting nervous. I had this bad feeling that the fins were too thin and were going to flutter too much. But nothing ventured nothing gained, and I decided to fly it. After getting my J350 reload from Al's Hobbies I tracked down Dean Roth to help me prep it in the casing that I borrowed from Adrian Butler. Norm Heyen inspected my rocket and went over the paper work, and then it was off to load it on the pad.

It was a beautiful liftoff, white flame shooting out the back, and a very straight boost. My fears about the fins fluttering are going away as it rises higher. The motor burns out and the rocket begins the 4000 foot climb to apogee. Suddenly, the rocket is twisting all over the sky, and there seem to be bits and pieces of something coming off. The next thing I know the rocket is falling back to earth on it's side, while what appear to be fins flutter down beside it. Somehow the parachute ejected before it hit the ground, but I wasn't really paying attention.

I knew that it wasn't a failure with the reload, which was a relief since I had borrowed the casing. My guess was that the fins were too thin and had broken off. As Norm was recovering the rocket I walked to where I had seen a fin come down, and found it in the weeds. In was intact, no breaks. I found two pieces of body tube that used to be between the fins, and another fin as I walked over to Norm, but couldn't find the third one (it was found the next day). Norm had retrieved the nose cone which had ripped itself loose from the Kevlar line I had used to tether it to the payload section. Apart from ripping the fins off the rocket survived the ordeal. Needless to say, I was bummed out the rest of the day.

As I was reading the Rec.Models.Rockets newsgroup later the next week I came across a posting from Andrew Waddell from Public Missiles (PML). He was responding to someone who had flown one of their rockets and had the same thing happen – the fins ripped off. What Andrew said was that the builder had probably forgotten to sand the fins where the epoxy would be applied so that it had something to adhere to.

<Insert sound of someone slapping their forehead – D'oh!>

Sure enough, I hadn't done that. The epoxy was nice and smooth where the fins had been in the fillets, and the fins had almost no sign of epoxy on them. Two of the fins had also cracked along the body tube joint. I looked at the PML catalog and many of their rockets use 1/16" thick G10 fins. Yes, my fins fluttered, but I now believe that if I had attached them correctly by roughing up the surface first that they would have held and my flight would have been successful. Having some instructions that told me to do this would have been very, very helpful.

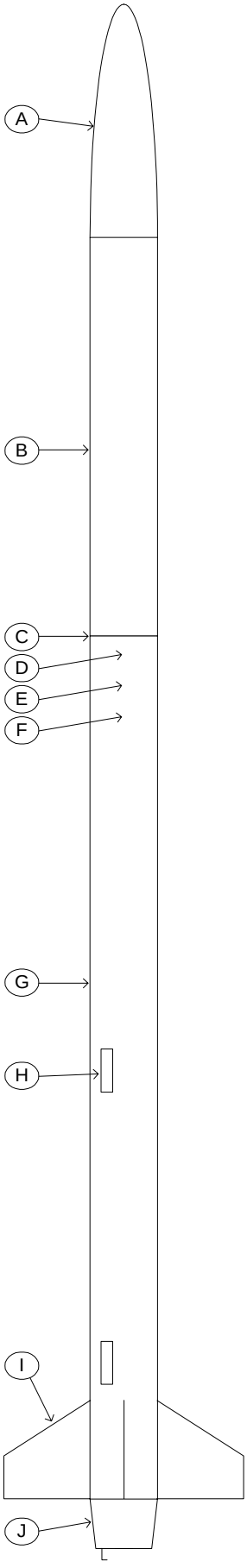
The baffle worked perfectly, there was very little soot on the Nomex parachute protector. I can rebuild the rocket, but I don't think I'll try another Level 2 attempt with it since it did suffer some damage. My plans now are to purchase a PML Endeavour (4" version) and try another Level 2 attempt later this year.

I'd like to thank the following people for their assistance:

- Steve Piette for his advice during the construction of my rocket.
- Adrian Butler for loaning me his reload casing.
- Dean Roth for taking time from his day to help me assemble the reload.
- Norm Heyen for helping with the paperwork, being one of my Certification team witnesses, assisting at the pad, and recovering the rocket.
- Steve Smith for his help at the pad and humor after the flight.
- Ken Hutchinson for acting as a one of my Certification witnesses.

Cutlass

Designed by Mark Kotolski (NAR 35707)



Parts List:

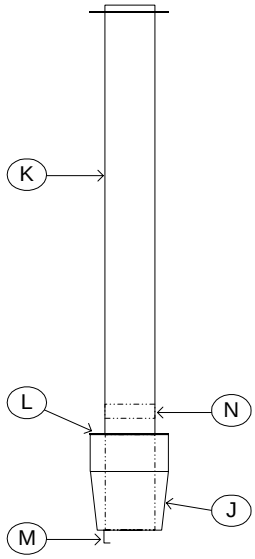
A. Nose cone PNC-50AC
B. Body tube 9" BT-55
C. NB-55
D. Screw Eye
E. 12" Parachute
F. Shock Cord, 1/8" x 36"
G. Body tube 18" BT-55
H. Launch Lugs, 1/8" x 1.25" (2 needed)
I. 3/32" balsa finstock
J. TA5055 (plastic)
K. BT20 x 8.5", motor tube
L. RA2055 centering rings (2 needed)
M. Motor hook
N. EB20 thrust ring

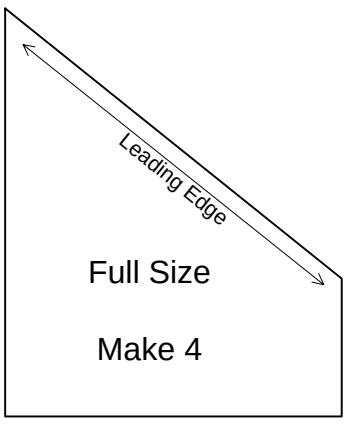
Recommended Motors:

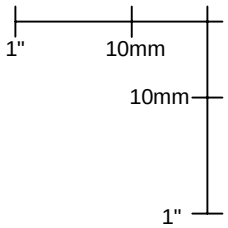
B4-4, B6-4, B8-5, C6-5, D13-4W,
D21-7T, D24-7T, E25-7T

Notes/Instructions:

- If a balsa noseblock is not available, use a tube coupler with one end closed.
- Cut off ’50’ size end of TA5055, cut off tapered portion of ’55’ end. Leave sleeve portion to mate with body tube.
- Glue one 2055 ring 1/2" from one end of tube. Glue in thrust ring so 1/4" of motor sticks out attach motor hook and other 2055 ring.
- Motor tube is flush with end of boattail.







Rocket Math 5: Scaling by Example

by Norm Dziedzic (NAR 72426)

Introduction

A frequent topic on the online discussion group rec.models.rockets (r.m.r.) concerns scaling models. Scaling a model means making a larger or smaller version of that model which replicates all of the details and proportions of the original. If done properly, when you look at a scale model, you immediately recognize its shape and say something like, "Oh wow, that looks like an Estes' Mosquito but it's 5 times bigger!"

To demonstrate scale modeling, this Rocket Math installment will go through the step by step procedure of down-scaling the popular PML[1] Small Endeavour to a BT-50 size tube to make a "Mini-Endeavor" (We'll leave the name "Micro-Endeavor" for the Quest Micro Maxx version ☺).

Body Tubes Rule

It's not a political statement but a cold hard fact that, unless you "roll your own," standard body tube (BT) sizes will rule your scaling efforts. Since components like tubes, nose cones and centering rings are only available in specific sizes, the scaling factor is usually based on a ratio of the original tube size to that of a larger or smaller standard tube size.

The PML Small Endeavour is based on the 2.684" dia. Quantum Tube (QT) and we will be scaling it down to use a BT-50 body tube which has an outside diameter of 0.976". Once we know the main tube sizes, the first step is to find the *scale factor (SF)* between the two. For this we create a fraction of the **new** BT size over the original BT size or:

$$SF = \frac{New\,Size}{Original\,Size} = \frac{0.976}{2.684} = 0.364 \qquad [1]$$

All **length** dimensions of the original model are multiplied by the SF to determine the corresponding length in the scaled version of the model. Equation [1] also works for up-scaling as long as you always put the new size over the original size. For an up-scaling project, the SF will be greater than 1.0.

To Scale or Not to Scale?

People often ask if the angles of fin patterns and transitions are also *multiplied* by the *SF*. The simple answer is NO. The reason is that angles, whether you measure them in degrees or radians are really a *dimensionless* measure. They are in and of themselves only a fraction of a full circle.

Another item which **wouldn't** be multiplied by the Scale Factor would be the *ratio* of an ogive nose cone (i.e. 5:1 ogive). As with the angles, ogive ratios are not associated with any particular dimensions so they are not scaled. However, the length of a nose cone **is** scaled.

Tools of the Trade

In order to scale a model you must have tools to measure the original model. To start with, you must have your basic ruler and tape measure. Another handy device is a *dial caliper* which come in a wide variety of qualities from $5 cheap plastic to Hundreds of dollar industrial models with digital readout. A nice compromise is a $20 stainless steel import caliper as shown in the figure. A drafting angle or small carpenters or machinist's square also comes in handy for projecting dimensions (see fin measurement - Figure 4).

Figure 1: Tools of the Trade

Come Scale Away

Alright, let's get down to business. With the scale factor determined, the next task at hand is measuring the relevant dimensions of the Small Endeavor and calculating the corresponding dimensions for our Mini Endeavour. To aid in this task, we'll create a table of the original and scaled figures.

Dimension	Orig.	Scaled
Body Tube Dimensions		
BT Diameter	2.684	0.976
BT Length	36.000	13.104
Fore Fin Front Loc.	27.000	9.828
Aft Fin Front Loc.	32.375	11.784
Fore Fin		
Root Chord Length	4.500	1.638
Tip Chord Length	1.000	0.364
Span	2.500	0.910
Sweep Length	4.750	1.729
Aft Fin		
Root Chord Length	3.000	1.092
Tip Chord Length	1.750	0.637
Span	2.500	0.910
Sweep Length	1.250	0.455
Nose Cone		
Nose Cone Length	11.250	4.095

BT Length

For larger models like our example, this is best done with a tape measure as shown in Figure 2. Hooking the end of the tape measure at the forward end of the BT, we can simultaneously measure the BT overall length, and the locations of the leading edges of the two fin sets. These figures are entered into the table. Multiply the measured number by the scale factor to get the new or scaled dimension.

Figure 2: Body Tube Measurements

Fin Measurements

The Small Endeavour fins are standard trapezoidal shapes. The normal way to define this type of fin is by the four parameters shown in Figure 3.

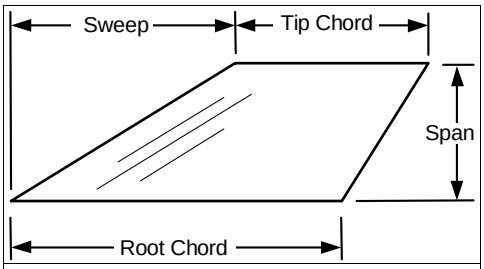


Figure 3: Trapezoidal Fin Parameters

Since none of the dimensions are all that large, we will use a ruler to measure the Root Chord, Tip Chord, and Span dimensions. For the Sweep, the drafting angle comes in handy to project the point at the leading edge of the root chord up to the level of the tip chord as shown in Figure 4. The aft fin can be measured in a similar manner to get the figures shown in the dimension table.

Figure 4: Measuring Fin Sweep

Nosecone

The nosecone is another place where the drafting angle comes in handy. The best way to measure the true length of the nose cone is to place it in the body tube and lay the tube on a table. Place one of the sides of the square on the table and butt the other end against the point of the nose cone. Now you can measure from the shoulder of the nosecone to the vertical side of the angle in a manner similar to that shown in Figure 4.

*(**Rocket Math** continued on page 6)*

*(**Rocket Math** Continued from page 5)*

Stability (Center of Pressure, Cp) Location

The Cp (Center of Pressure) of a rocket **does not scale** like other dimensions. Using the RockSim method in RockSim 4.0[2], the Cp of the PML Small Endeavour is at 38.446" from the nose. Scaling this would give 13.467 but when the Mini Endeavour dimensions are entered into RockSim, the Cp is found to be 14.253. In this case, scaling the Cp gave a conservative estimate but this may not always be the case. **Always** re-check the Cp location of a scaled model using the new dimensions. **Do not scale it from the original**.

RockSim Files of the PML Small Endeavour and Mini Endeavour have been uploaded to the Apogee RockSim Rocket Design Library at the Apogee Web Site[2]. Your best bet to find them is to search on my name as the files are in no particular order.

Other Considerations

There are a few other items which you may or may not want to scale depending on how accurate you want the scale model to be.

First and foremost is the nose cone. For our example, the closest standard nose cone is the Estes PNC50Y which is 4.35" long vs. the 4.095 calculated length. For most cases this deviation is minimal. For scale competition, you can order a custom nose cone from BMS[3] to the exact dimensions you require.

Fin thickness can be another tricky area. Again, standards come into play here as materials are only available in certain thicknesses. The strength of the fins must also be considered and designed to be adequate for the motors to be used in the model. The PML Small Endeavour is supplied with 1/16" G-10 fiberglass fins. These would scale to 0.023" which could be made by sanding down 1/32" thick G-10 but that is a lot of work. Since I plan on trying some 18mm D engines in my Mini-Endeavour I chose 3/32" basswood with through wall mounting for the fins. If you're sticking with A,B,C motors, 1/16" or 3/32" Balsa fins mounted to the outside of the BT should work fine.

When it comes to interior components (centering rings, motor mounts, bulkheads) all bets are off from a scale standpoint. These items must first be designed for the safety of the model and available motor sizes. For instance, the Small Endeavour has a 38mm MMT. Scaling this by our SF of 0.364 gives a 13.8mm MMT. Since there are no 13.8mm motors (or tubes), the plans which are found in this issue of the Leading Edge include an 18mm MMT.

Conclusions

Scaling is a nice way to pay homage to real rocket designs or you favorite kits. With some simple measurement techniques and a little record keeping, you can easily scale up or down any design which you can put a ruler to. Or, in the case of a real rocket, if you can find a drawing with the original dimensions, you can easily scale these to fit standard model rocket or High Power component sizes.

You can send questions, comments or suggestions for future Rocket Math articles to the author at ndzied1@interaccess.com or by regular mail to the Leading Edge Editor. Note: Permission was granted to the author by PML to use the Small Endeavour as the basis for this article.

Notes:

1. Public Missiles Ltd.: http://publicmissiles.com/
2. From Apogee Components: http://www.apogeerockets.com
3. Balsa Machining Service: http://user.mc.net/~bms/

Fibre Glast Epoxy Systems
by Norman Heyen

While many of you use West System or System 3 epoxy, I started using Fibre Glast products about 2 years ago and certainly endorsed them. Based out of Brookville, OH, Fibre Glast sells epoxy resins, polyester resins, fillers and cloth, as well as equipment for vacuum bagging and applications. Based on my needs of finding a better epoxy then the hobby store variety, I discovered the 60 minute hardener gave me plenty of time to lay-up layers of glass without getting into trouble of being half done and having the epoxy starting to cure. Fibre Glast also makes a 120 minute hardener, but I've never run into a case where I need the extra time.

With this system, the epoxy is mixed 3 parts resin to 1 part hardener (by volume). This allows me to use 3 cc syringes to mix either 4, 8 or 12 cc of epoxy. Depending on the job, these are pretty easy quantities to use. A pair of fin fillets or a bulkhead fillet uses about 4 cc, maybe less. Glassing larger sections, like body tubes require more, maybe 20 or 24 cc. I've never mixed more than that, but if you try it, you need to know that epoxy is exothermic, meaning that it gives off heat as it cures. Heat makes the epoxy cure quicker, generating more heat, which cures the epoxy sooner, which generates more heat, etc. Too much at one time can literally melt plastic cups and cause the epoxy to set within a few minutes. The advantage of an even ratio is that it isn't too hard to measure. Some other varieties mix at 4.3:1, which is too hard to measure without a gram scale.

I use this set (resin – System 2000 / 60 minute hardener – System 2060) for both fiberglassing and part attachment. With the 60 minute pot life, it allows plenty of time for the epoxy to soak into porous surfaces very well. I've taken apart some of my rockets (or at least seen where they have been taken apart... :-) and epoxy has soaked into plywood fins almost 1/4". Same with paper or PML tubing, makes for strong joints that are stronger than the materials being joined. About the only disadvantage is how runny the mixture is. I generally apply and wait for about 15 minutes and blot up the excess. It is always easier to wipe epoxy up than to sand it off after curing. I go back again in another 15 minutes or so. And again in another 15 minutes or so.

For glassing of tubes up to 5.5", I've had good luck using 4 ounce cloth, nothing fancy, just the normal weave. I've tried to use heavier (too hard to fill in the weave) and lighter (handles like wet tissue paper) and am happiest with this weight. I suspect that larger tubes would be best with a heavier cloth and a finish coat of 2 or 4 ounce cloth. For what it's worth, I use two wraps, applied at the same time. Work the wrinkles and bubbles out from the center to the ends and dab (or stipple) epoxy into 'dry' areas.

Fillers are used to either make the epoxy lighter or stronger. I typically use a product called micro-balloons for fin fillets. I mix this to about the consistency of toothpaste and smooth it into the surfaces. With this mixture, sanding is quick and easy. Since micro-balloons don't add any strength, you can use milled glass fibers, chopped graphite or even Kevlar pulp. These materials greatly add to the strength of the fillets, but are harder to sand and finish.

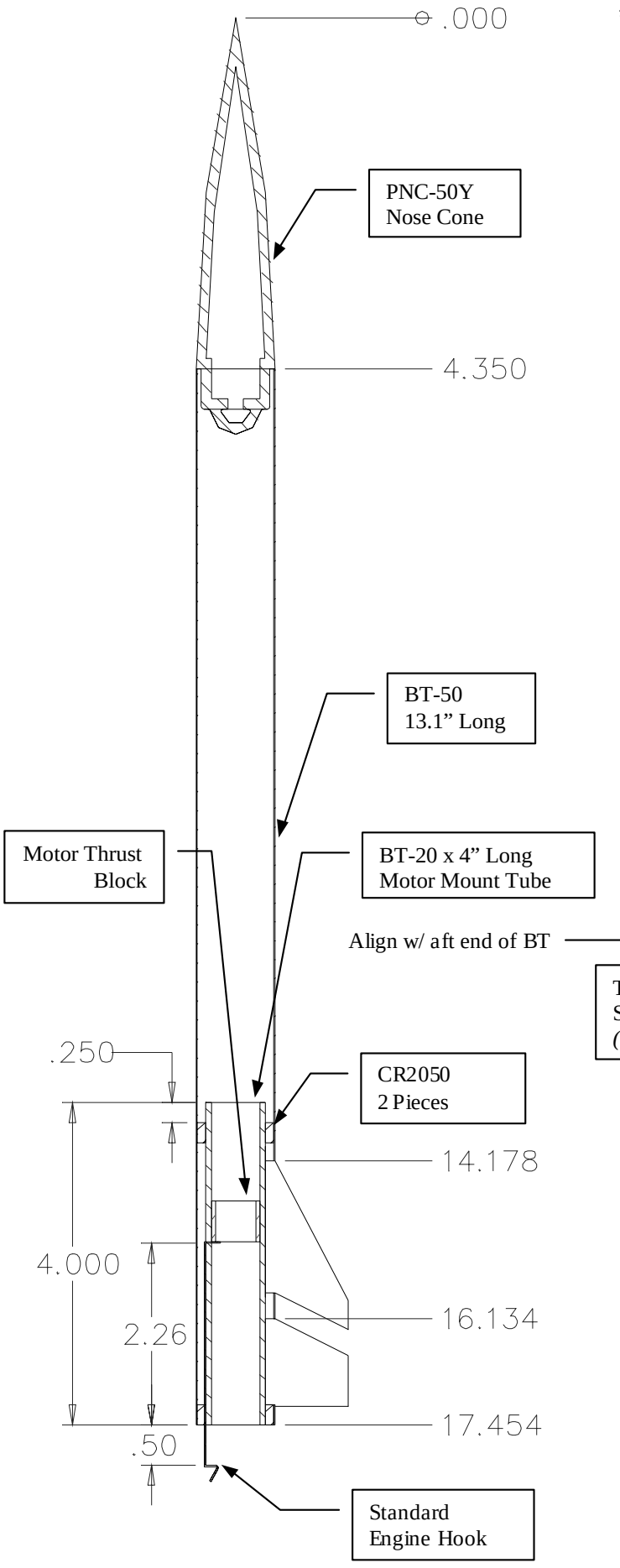
A couple of tips. Nothing sticks to wax paper. Use this fact to help make clean up easy. I tape sheets over cardboard on my work surface. It also works well for laminating fins. Make a sandwich out of a stack of wax paper, epoxy, glass cloth, fin, glass cloth, epoxy, and wax paper. Lay these between two flat surfaces and apply lot of weight. The result is a nicely finished fin surface in a day or so. To cut fiberglass cloth, I bought a wheel cutter at a fabric store. It resembles a small pizza cutter, except the blade is about the sharpest thing that I've ever used. It will cleanly cut fiberglass cloth.

Last but not least, safety. Always wear protective gloves. Either bulk plastic (very cheap) gloves like you see cafeteria workers wear. Cheap and light weight, but rather slippery and hard to manage. Latex surgical gloves fit better, but are more expensive. You should never, ever get epoxy on your skin. You will eventually become allergic to epoxy, to the point where you can't use it anymore without risk of needing a dermatologist. If you are going to sand finished epoxy, invest in a breather mask to filter the epoxy and fiberglass dust out before it gets into your lungs. Don't let your hobby become a health risk.

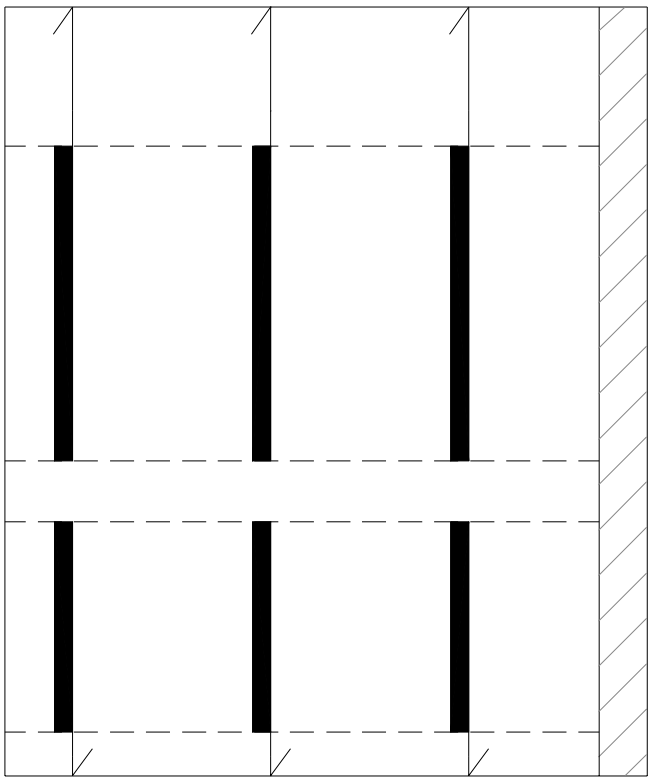
Fiber Glast has a web site at http://www.fibreglast.com, but call them at 1-800-821-3283. They have always been friendly and answered my questions and offered helpful suggestions. For a complete 'glassing solution, you can't go wrong with Fibre Glast.

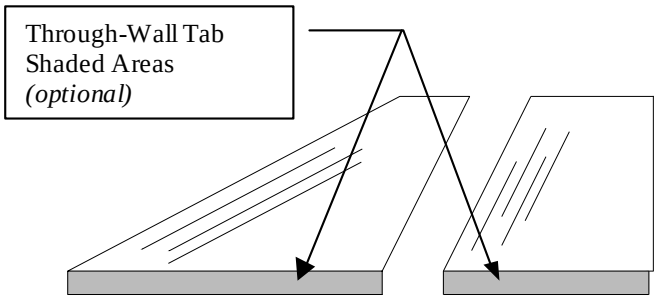
MINI ENDEAVOUR

A BT-50 Scale PML Small Endeavour
By Norman Dziedzic NAR#72426
½ Scale
W/ permission from PML

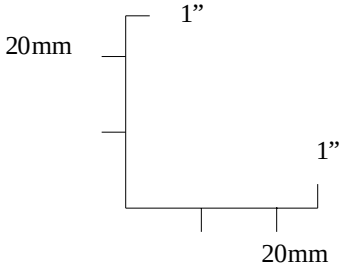


Fin Marking Guide. Overlap at right.
Cut out Black Areas for Through-Wall Fins





Fin Patterns. Make 3 Each 3/32" Basswood or Balsa



Space Launch Report for May-June 2000

by Tim Johnson

There were 14 May-June space launches, all successful despite the debut of three new launch vehicles – Rockot/Breeze KM, Atlas 3A, and Proton-K/Breeze M. At mid-year, Proton and Soyuz led all launchers with six flights each. Atlas 2A(S) flew four times, Ariane 4 and Delta 2 three times each, and STS twice. Thirteen other rockets flew once each, with two failures. The collapsing low earth orbit (LEO) comsat market led to only 15 LEO launch attempts; a minority of the total for the first time in years. Iridium shut down. Uncertainty surrounded Orbcomm, Globalstar, ICO, Roton, and Kistler. Delta 2 production fell 50% from 1999, forcing Boeing to start abandoning much of its Huntington Beach plant. The geosynchronous earth orbit (GEO) market held, however, and Beal pressed on with development of its monster BA-2 launcher for that market.

Liftoff of the first Atlas 3 (AC-201)
International Launch Services Photo

Atlas 3 Debut

Atlas 3A AC-201, the first U.S. rocket powered by a Russian engine, orbited Eutelsat's W4 comsat on May 24 from Cape Canaveral's SLC 36B. The 3,190 kg W4 satellite entered a supersynchronous transfer orbit (GTO+). The flight was the first "transition generation" U.S. expendable launch vehicle success, beating Boeing's rival Delta 3. Lockheed Martin said the flight eliminated 80% of its Atlas 5 EELV program risk.

AC-201's stretched Atlas first stage was powered by a twin-chamber RD-180 LOX/kerosene engine (No. 2T) designed and built by NPO Energomash of Khimky, Russia. RD-180 derives from the four-chamber RD-170 developed to power Energia's strap-on boosters. The engine produces up to 423,310 kgf thrust and can throttle in a 40-100% range. AC-201 also used the first Single- Engine Centaur. Its RL-10A-4-1B LOX/LH2 engine deployed a nozzle extension for two burns. The first burn put AC-201 into a parking orbit. The second put the vehicle into GTO+.

Two Atlas 2As fly for NASA

AC-137, a $90 million Atlas 2A, orbited NASA's GOES L on May 3 from Canaveral SLC 36A. AC-137's Centaur stage injected the 2,217 kg spacecraft into GTO+. $250 million GOES L, the fourth of five Geostationary Operational Environmental Satellites built by Space Systems Loral, will be named GOES 11 once operational.

AC-139, another Atlas 2A, launched NASA's first Hughes-built Tracking and Data Relay Satellite (TDRS-H) from Canaveral's SLC 36A on a $395 million June 30 mission. AC-139's Centaur used twin extendible nozzles to put the 3,180 kg HS-601 spacecraft into a subsynchronous transfer orbit (GTO-). TDRS-H will become TDRS-8 when operational. AC-139 was the 51st consecutive Atlas Centaur success and the 113th success in 128 flights since 1962.

Proton Season

A Proton-K/Breeze M orbited Gorizont (Horizon) 45, a 2,200 kg Russian comsat, from Baikonur Area 81 Pad 24 (LC 81P) on June 6. The four stage rocket was the first to test Breeze M and the first equipped with "Phase 2" second and third stage engines. Breeze M is a restartable hypergolic stage that replaces Energia's LOX/kerosene Block DM. The now-all-Krunichev vehicle can push more mass to GEO. Breeze M is a Breeze K core with an added torus drop tank. The stage produces less thrust, but is more fuel efficient, than Block DM. Breeze performed five burns during this 11.5 hour mission. The first put the stage into a parking orbit. Two perigee burns, 2.5 hours apart, put Gorizont into GTO, where Breeze M dropped its torus tank. The stage fired again at apogee to reach GEO. A fifth burn lowered the stage orbit after Gorizont 45 separated.

A Proton-K/DM-2M orbited the Express 3A comsat for Russia's Intersputnik from Baikonur on June 24. Proton launched from Area 200 Pad 39 (LC 200L). The 2,600 kg spacecraft separated into GEO about 6.5 hours later after two Block DM-2M burns.

A Proton-K/DM3 launched Sirius-1 from Baikonur LC 81P on June 30. The vehicle flew a two-burn Block DM3 mission to put the 3,800 kg Loral FS-1300 spacecraft into an unusual 6,200 x 47,100 km x 63.4 deg transfer orbit. Sirius-1 later boosted itself to a 24,000 x 47,000 km orbit meant to provide better digital radio reception for North American mobile subscribers. This was the 14th ILS Proton success in 15 attempts.

Proton Sirius-1 launch
International Launch Services Photo

Rockot in its launch/transport container
Eurockot photo

Rockot/Breeze KM Commercial Demonstration Flight

The first Eurockot Rockot/Breeze KM succeeded in its Commercial Demonstration Flight premier on May 16. The three stage rocket launched from LC 133, a former Kosmos 3M pad, at the Plesetsk Northern Cosmodrome, Russia. Breeze KM burned twice to put two 660 kg mass simulators; Simsat 1 and 2; into a circular 86.4 deg LEO. EUROCKOT is a joint Daimler-Chrysler/Khrunichev venture.

Rockot's first two stages are based on Krunichev's SS-19 ICBM. The 17.2 meter long first stage is powered by four Khimavtomatiki RD-0233 cardan-gimballed engines that together produce a total 191,837 kgf thrust. The Breeze KM third stage hangs in an interstage atop the second stage. All stages burn N204/UDMH. Rockot launches from a transport container mounted above ground. The 107,000 kg vehicle can lift 1,900 kg to LEO.

Soyuz-U

A TsSKB Progress Soyuz-U orbited Kosmos 2370 from Baikonur LC 1 on May 3. The spacecraft, probably a digital imaging reconsat, entered a 64.8 deg LEO. Officials said it was the 380th 11A510/11A511-series Soyuz launched from Baikonur. About 807 Soyuz

launchers have flown since 1965, most from Plesetsk.

Titan 402B-29
$432 million Lockheed Martin Titan 402B-29, put the $250 million, 2380 kg Defense Support Program DSP-20 early warning satellite, into GEO from Canaveral on May 8. It was the first successful Titan 4 launch from the Cape since May 1998. The 861,687 kg vehicle lifted off from SLC 40, where it had stood for 11 months. Two-stage IUS-22 put DSP-20 into GEO about 6.5 hours after liftoff. It was the 25th successful Titan 4 mission in 29 attempts since 1989.

Delta 278
Delta 278, a Boeing Delta 7925 with nine strap on solids and a Thiokol Star 48B third stage, orbited GPS 2R-4 from Cape SLC 17A on May 11. The $50 million 3.5 stage rocket propelled the $42 million Global Positioning satellite into a medium transfer orbit (MTO) after two second stage burns and a third stage burn. GPS 2R-4 later raised itself into a circular 20,350 km orbit.

STS-101
Shuttle Atlantis (OV-104) began NASA's STS-101/ISS 2A.2a mission on May 19 from Kennedy Space Center LC 39A, carrying seven crew and 1,700 kg of supplies on a 10-day mission to service the International Space Station (ISS). Aboard were Commander James Halsell, Pilot Scott Horowitz, and Mission Specialists Mary Ellen Weber, Jeffrey Williams, James Voss, Susan Helms, and veteran Russian cosmonaut Yuri Usachev. Williams was the only "space rookie". Atlantis carried a SpaceHab Logistics Double Module and an Integrated Cargo Carrier. The orbiter docked with ISS on May 21, undocked on May 27, and landed at KSC on May 29.

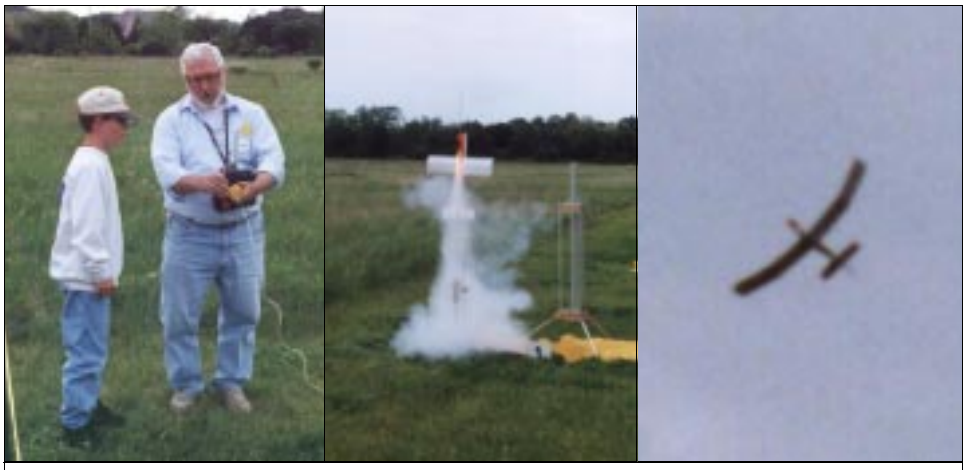
Pegasus XL
The 29th Orbital Sciences air-launch Pegasus orbited TSX-5, an experimental milsat, on June 7. The three-stage Pegasus XL was dropped from Orbital's L-1011 "Stargazer" after staging from Vandenberg AFB, California. TSX separated into an elliptical LEO. It was the 15th consecutive Pegasus XL success and the 24th full Pegasus success in 29 attempts since 1990.

CZ-3
A three stage CZ-3 (Long March 3) put China's 1,250 kg Fengyun 2 weather satellite into GTO from XiChang on June 25. The rocket's LH2/LOX third stage performed two burns. It was the 13th CZ-3 launch and the 61st flight of the CZ series.

Cosmos-3M
A two-stage NPO Polyot Cosmos-3M orbited Russia's 825 kg Nadezhda-M military navsat and two smaller spacecraft from Plesetsk LC 132 on June 28. The payloads entered a 650 km sun synchronous orbit. The second stage Khimmach 11D49 16,000 kgf thrust engine restarted at apogee to circularize the orbit.

Space Launch Report is online, in depth, at:
http://www.pair.com/tjohnson/slr.html

May 2000 Club Launch at Greene Valley
Photos by Kurt Gunther



Three photos of Tom Pastrick and an unidentified helper launching Tom's flop-wing boost glider

Prepping and launching a SR-71 Blackbird. This must have been the launch for cool gliders!

Above, Kurt get a liftoff photo of a Fat Boy. Right, a rocket being prepped while others watch the launch.

Confused Stages – Stage 14
by Jonathan Charbonneau

"The Hound Dog and Bomarc are missiles," say Tom. "They are also rockets."

"Not so," Syed exclaims. "They're jet planes."

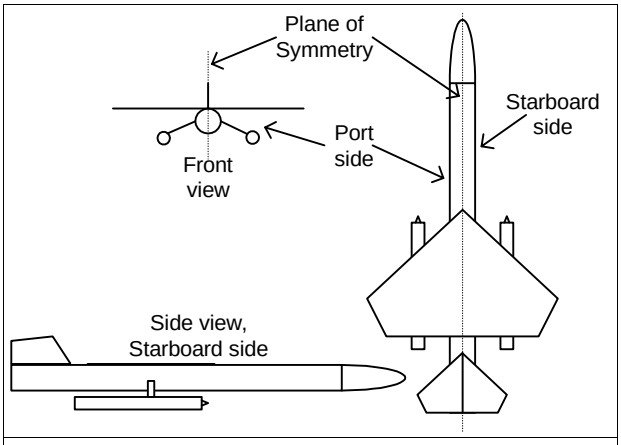
Bill mentions, "The Talos missile is a rocket."

"No, it's a jet", states Syed.

Care to guess who is right? If you have guessed Syed, you're right. Some missiles are jet powered. If you are wondering why some missiles are jet powered and/or airplane shaped, read on. This stage will clear up your questions about shapes and engines.

In the designing of a missile, there are two types of symmetry: bilateral and radial. If a vehicle has bilateral symmetry, its right or starboard side is a mirror image of its left or port side. If a vehicle has radial symmetry, it can be divided into three or more similar pieces like a pie. Each of these types of symmetry has its attributes.

A missile with bilateral symmetry looks more like an airplane. Examples are the Hound Dog, Bomarc, Snark and Tomahawk. The wings on a bilaterally symmetrical missile produce lift to sustain it against gravity. This is an advantage as it allows the engine to concentrate on propelling the missile towards its target instead of wasting power counteracting gravity. This advantage does have a price, however. As efficient as it is for horizontal flight, it is not good for vertical flight. When a missile with bilateral symmetry flies straight up, the wings tend to make it curve towards the direction the dorsal side is facing.



Example of Bilateral Symmetry (Bomarc illustrated)

A missile with radial symmetry is shaped like a rocket. It doesn't fly worth a hoot horizontally, but it flies true on the vertical. All ballistic missiles are of this shape. Examples include: Minuteman, MX Missile and Thor. Most missiles to be used against air targets are also of this shape (e.g. Sidewinder, AMRAAM and Phoenix). This is because a radially symmetrical missile can easily maneuver in any direction. No rolling is required when yawing.[1] If a bilaterally symmetrical missile tries to yaw without rolling, it will skid.[2] And, if it rolls too much, it will slip.[3]

The type of engine is another factor in missile design. Some missiles are jet powered instead of rocket powered. Each engine has its attributes.

Rocket engines are more powerful; they give more speed. This is why most missiles that are used against air targets are rocket powered. The Bell X-1, the first airplane to break the sound barrier, was rocket powered. So was the X-15, the first plane to fly at hypersonic[4] speeds.

Rocket engines also work where there is no air as they carry their own oxidizer. This is why IRBM's[5] and ICBM's[6] are rocket powered. It is also why only rockets can operate in space.

Jet engines have advantages too. Since jet engines are air breathing, the space in the airframe that would otherwise be occupied by the oxidizer is freed up to hold more fuel. This increases the missiles range considerably. Consequently, where speed is of little importance, a missile that operates entirely within the atmosphere, is jet powered. All cruise missiles are jet powered.

Summary: Bilateral symmetry (airplane shape) is best for horizontal flight. Radial symmetry (rocket shape) is best for vertical flight. Rocket power is best for high speed. Jet power is best for long distance when high speed isn't needed.

Superman's Word of the Wise

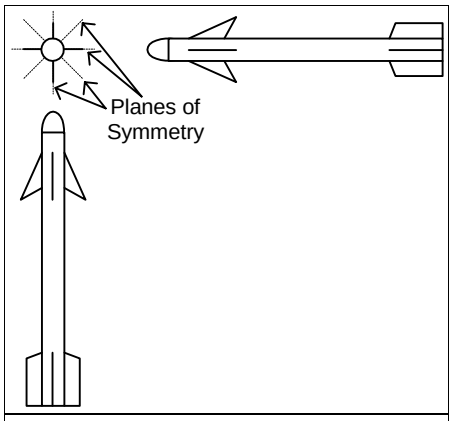
1. Although this stage mentions missiles a lot, **I do not**, in anyway, encourage anyone to make a missile or use any flying model rocket or high power rocket as a missile. Making scale models of missiles that are flown in accordance with the safety code **is** permitted.

2. As of this writing, it is not known whether or not model airplane engines are air-startable.

3. Always follow the NAR rocketry safety codes.

Notes:

1. Yaw is an aviation term that means to turn
2. Skid means to go off on a tangent to the intended turning arc
3. Slip means to lose altitude from too little life when turning
4. Hypersonic refers to speeds of over 5 times the speed of sound
5. IRBM stands for Intermediate Range Ballistic Missile
6. ICBM stands for Intercontinental Ballistic Missile



Example of Radial Symmetry (Sidewinder illustrated)

Rocket Vision offers Mid-Power Starter Kit

For a limited time only, Rocket Vision is offering free shipping (in the continental United States only) on our Mid-Power Starter Kit. (http://www.rocketvision.com/Products/starter_kit.asp)

The "Ultimate Starter Kit" includes the buyer's choice of two Rugged- Rockets, a Trans-Pod Launch Pad, Veri-Fire Solo Launch Controller, 1/8" launch rod, and four E15-4 motors. Purchased separately, the contents of the Starter Kit would cost $212.70. Standard shipping, via USPS is $9.00.

The Starter Kit is currently available for a total cost of $174.95 – a savings of $46.75 over the cost of the separate components and standard shipping.

For complete details, go to www.rocketvision.com and click on the "Great Deals" button or the "Ultimate Starter Kit" picture, or give us a call at 800-568-2785.

Janet S. Hendrickson
Director of Marketing
800-568-2785
info@rocketvision.com

Welcome to the Club!

Andrew Andersen, Stephen R. Andrews, Kevin, Nancy and Rachel Bare, Greg Cisko, Michael, Terri, Benjamin and Meredith Edwards, Joseph R. Franck, Kurt and Karen Gunther, Bobby, Patrick and Mariclare Kerrigan, Nick Krol, Michael, Mike Jr and Kaitlin Sacco, William and David C. Schneider, June M. Hershey, Jeremy Shafton, Mike and Mary Wlodarski, Robert, Fay and Nicholas Woodhouse have all joined NIRA in the past few months.

Welcome to the club!

LDRS-20 Press Release

July 15, 2000

The Rocketry Organization of California (ROC), Tripoli Anaheim Prefecture #48, is pleased to announce they have been selected to host LDRS 20, July 19-22, 2001, at Lucerne Dry Lake, California. This will be the 20th anniversary of LDRS, which is the annual national launch event of the Tripoli Rocketry Association, Inc. (TRA). LDRS 20 will be co-hosted with LTR, Tripoli Los Angeles Prefecture #007. ROC invites all TRA members to "Return to the Birthplace of High Power".

ROC brings to bear years of experience hosting its semiannual "ROCstock" events, which draw hundreds of fliers from all over the Southwestern US. ROCstock XI, just completed, featured over 800 flights spread over two and a half days, with an accumulated Newton-second total equivalent to a small "S" motor. The normal FAA waiver for Lucerne Dry Lake is 5,300 feet (1,600 meters) above ground level (AGL); however, ROC works closely with the local FAA and windows to 10,000 feet (3000 meters) will be available all four days. Single motors to a maximum of a full "M" motor (10,240 Newton-seconds); or motors combined to a maximum of a full "N" motor (20,480 Newton-seconds) may be flown here.

Lucerne Dry Lake is located in the Mojave Desert of Southern California, near the towns of Victorville and Barstow. Many lodging options are available within 30 minutes of the launch site; Ontario International Airport (ONT) is just one hour away. Also, local attractions such as Palm Springs, Big Bear Lake, and Disneyland are within easy driving distance of the site.

The Rocketry Organization of California (ROC) is Prefecture #48 (Tripoli Anaheim) of the Tripoli Rocketry Association, Inc. ROC is also Section #538 of the National Association of Rocketry (NAR). ROC is based in Southern California.

For further information: http://www.ldrs20.org/ or http://www.rocstock.org/

Contacts:
Rick O'Neil ROC Prefect 909-427-9157
Greg Lawson ROC President 562-865-3946
Rick Magee LTR Prefect 805-584-6934
Bruce E. Kelly TRA President 801-225-9306

*(**Watch the Grass Grow** continued from page 1)*
will need to bring your own launch systems for small rockets.

Normal NIRA field rules and flight cards will be used for non HPR rockets. All "complex" rockets must go through the RSO safety check before going to the pad. Of course, with a 5000 foot waiver and lots of space, this is the time to bring out the big stuff that you can't fly at Greene Valley. Otherwise, there's nothing to do but sit around and watch the grass grow.

The only other rule for the sod farm is **do not drive on the grass**. This includes freshly seeded areas that may just look like dirt. Please follow our signs and only drive where directed. We usually don't know where we'll be set up until we get there and survey the field. Please clean up any mess and use biodegradable wadding.

Saturday evening, many of us will head to dinner at the Heritage House, at the south end of Harvard where Routes 14 and 23 fork. It is right next to the Amerihost Inn (815-943-0700).

Directions to Beaver Run Sod Farm:
The sod farm is located north of Harvard, IL just off Route 14, and just south of the Wisconsin border. The best way to get there from the Chicago area is to get to take I90 west to the Marengo exit, and then follow Route 20 west to Route 23. Take 23 north into Harvard. 23 meets with 14 at the south end of Harvard.

Alternately, take Route 14 (Northwest Highway) all the way into Harvard, This will take you through Palatine, Barrington, Cary, Crystal Lake, and Woodstock.

Once you are heading north/west on 14 you need to go to and through Harvard which is only a few miles south of the Wisconsin border. As you continue on 14 beyond Harvard you will pass the large Motorola factory on your right. Once you pass the factory start looking for Yates Road on your left, about 2-3 miles past the factory. Turn left (west) on Yates and continue to its end, a tee intersection with Lilja road. Turn left (south) on Lilja, follow it around a 90 degree bend to the right and the Beaver Run Sod Farm will be on the right about a quarter mile past the bend. Look for our signs to see where we are flying that day. Do not drive on any grass or freshly seeded areas, stay on the dirt road only.

HERITAGE HOUSE (815) 943-6153
21225 E Us Highway 14
Harvard, IL 60033

AMERIHOST INN (815) 943-0700
1701 S Division St
Harvard, IL 60033

For Sale
Jonathan Charbonneau has the following items for sale. See him at a meeting or launch for further information:

- Estes Apollo XI (open but complete) $40 or best offer
- Aerotech Mantis launch pad and complete Interloc controller (new) $60 or best offer.

NAR Standards and Testing News

Subject: R63: NAR S&T CLARIFICATION
In response to member and manufacturer requests, the NAR Standards and Testing committee has examined the question of gluing something (such as a thrust ring) to the external surface of a rocket motor casing. We find that this does not modify the motor case and so long as it does not modify motor performance, this does not violate the NAR safety codes.

Note that NAR Contest Rules (the "Pink Book") may require further limitations for NAR Contest flights.

Jim Cook, Secretary for
NAR Standards & Testing
<JimCook@AOL.COM>

Jack Kane, Chairman

Cesaroni Technology/Black Sky Pro38, Welcome To High Power!

(from rec.models.rockets on June 21, 2000)

Dear RMR'ers,
The following six Cesaroni Technology/Black Sky Pro38 rocket motors are TMT Certified Motors and will be added to the TMT Certified Motor List and to the TMT web pages as soon as possible. These motors are certified for three years and are due for recertification on 1 July 2003.

137G60-12A	265H110-13A
402I170-15A	540I240-15A
670J300-15A	800J360-15A

These are 38mm reloadable motors with 1, 2, 3, 4, 5 or 6 propellant grains. The "-12A, -13A, -15A" suffixes designate the delay module used with that motor. The motor comes with the correct delay module already in the packaging. The delay module may be adjusted to one of five different delays per the manufacturer's instructions and the included delay chart. The motors may also be used with electronic ejection per the manufacturer's instructions.

Each motor comes complete with a 1.3 grams black powder ejection charge and an electric match. Absolutely no augmentation of the electric match is needed. These motors light IMMEDIATELY with just the included bare match.

Side note: When the TMT testing group saw how fast these motors come up to pressure with just the bare e-match, there was immediate discussion of using them as second stage motors. There was also some grumbling because mean old Sue wouldn't let them fly "just one". Tough.

Enjoy, ladies and gentlemen. The Pro38 motors were a pleasure to test.

They'll be a real kick to fly.

Sincerely,
Sue McMurray
TMT Chair

A Few Photos from MRFF 2000
Photos by Daniel Cordes

At far left is a rocket that was launched on a full K engine – it was a spectacular flight. At left is a rocket that Dan Cordes designed and built called the Silver Lightning 10, which is a 6'2" (dad sized) rocket which launched on an E engine. Below is a photo of the the launch table and several MRFF attendees.

C/O Jeff Pleimling
245 Superior Circle
Bartlett, IL 60103-2029

This may be your last newsletter! Check your label for the expiration date.
If it says Membership Expired or Membership Expiring, this will be your last newsletter!